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The characteristics of water-in-biodiesel emulsions produced using ultrasonic homogenizer



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Abstract The characteristics of the emulsified fuel is largely influenced by the production methods of the emulsion. Although, blending by means of mechanical blender is widely used, the efficacy of using direct ultrasonic homogenizer in producing emulsified fuels has not been explored extensively. Mechanical blender uses metal blades to shear and mix the liquids and the produced emulsion quality would depend on the blade design, rotating speed and mixing duration. Hence, the homogeneity of emulsions produced by different blenders is not consistent. On the hand, ultrasonic homogenizer utilized direct ultrasonic force to produce high frequency vibrating waves to disrupt the immiscible liquid layers and mixed the liquids. Consistency and homogeneity of the emulsion produced by any direct ultrasonic homogenizer can be realized by changing the ultrasonic power, frequency and mixing duration. The current work describes the vital characteristics of water-in-biodiesel emulsions (WiBE) produced by direct ultrasonic homogenization and subsequently, ascertaining the optimum emulsion blends that meet the recommended international fuel specifications for a diesel engine. A total of 48 WiBE samples were prepared and their properties were characterized. The variable parameters for the blends are water content varying from 9% to 15%, three surfactant dosages of 5%, 7% and 9%, and hydrophilic-lipophilic balance (HLB) values ranging from 6 to 9. The results showed that the water particles in the emulsion were uniformly distributed within the continuous phase (biodiesel) and the sauter mean diameter (SMD) values of the water particles were generally small at a mean value of 2.25 μm . Emulsions with 7% and 9% surfactant dosages were observed to have lower SMD values for HLB 7 and HLB 8 respectively. 33 out of 48 samples were

Abbreviations B5, 5% biodiesel; CEN, European Committee for Standardization; CO, Carbon monoxide; H₂O, Water; HC, Hydrocarbon; HLB, Hydrophilic-Lipophilic balance; NO_x, Nitrogen oxide; PM, Particle matters; POME, Palm oil methyl ester; SD, Surfactant dosage; SMD, Sauter mean diameter; WiBE, Water in Biodiesel Emulsions

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